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Date: December 6, 2002 **Name:** MARK GIARRATANA **Signature:** Mark D. Giarratana

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the Application of:	Edward L. Carver, Jr. Steven J. Skiptunas	)	Group Art Unit: 1743
on:	APPARATUS AND METHOD FOR MIXING FLUIDS FOR ANALYSIS	)	Examiner: L. Alexander
Serial No.:	09/198,004	)	
Filed On:	November 23, 1998	)	(Docket No. 116310.0032)

Commissioner for Patents
Washington, D.C. 20231

APPELLANT'S APPEAL BRIEF

Mark Giarratana
Registration No. 32,615
CUMMINGS & LOCKWOOD
Granite Square
700 State Street
P.O. Box 1960
New Haven, CT 06509-1960
Phone: (860) 275-6719
Fax: (860) 560-5919
Attorneys for Applicant

I. INTRODUCTION

In accordance with the provisions of 35 U.S.C. § 134 and 37 C.F.R. §§ 1.191 and 1.192, this Appeal Brief is submitted in triplicate in support of the appeal from the Office action mailed on March 29, 2002, finally rejecting claims 1, 3-6, 31 and 33-47.

A. Real Party In Interest

The real party in interest (and owner) is Drew Scientific Group Plc.

B. Related Appeals and Interferences

None.

II. STATUS OF THE CLAIMS

A. Status of Pending Claims

Claims 1, 3-6, 31 and 33-47 are pending in this application. Claims 1, 3-6, 31 and 33-47 have been finally rejected under 35 U.S.C. § 102(b) and each of these claims are on appeal.

B. Status of Canceled Claims

The subject application, U.S. Patent Application Serial No. 09198,004 was filed on November 23, 1998. The subject application was filed with thirty nine (39) claims.

In a Preliminary Amendment, mailed on November 23, 1998, original claims 7-30 were canceled and new claims 40-43 were added. In an Amendment mailed on August 9, 1999 claims 2 and 32 were cancelled. Thus, the following claims have been canceled during prosecution of the subject application and are not on appeal herein: claims 2, 7-30 and 32.

III. STATUS OF THE AMENDMENTS

There were no amendments filed subsequent to the final rejection of this application. Appellant filed a Response To Office Action (Final Rejection) under 37 C.F.R. § 1.116 on July 29, 2002, offering arguments to surmount the rejection. An Advisory Action was then issued stating that the arguments contained in the response failed to overcome the rejections.

IV. SUMMARY OF THE INVENTION

Appellant's claimed invention is directed to apparatus and methods for analysis of reagent mixtures. A first apparatus is for analysis of reagent mixtures having a plurality of reagent-mixture components including a sample of blood. The apparatus includes (1) means for pumping each of a plurality of reagent-mixture components including the sample of blood in a respective stream at a respective predetermined flow rate, (2) means for combining at least one reagent-mixture component stream into a stream of at least one other reagent-mixture component stream for mixing the plurality of reagent-mixture components into a combined reagent-mixture stream, (3) means for forming each of a plurality of different selected reagent mixtures in the combined reagent-mixture stream by adjusting the flow rate of at least one of a plurality of reagent-mixture components in accordance with a flow-rate ratio of reagent-mixture components corresponding to each respective selected reagent mixture, and (4) means for at least one of (i) chemically analyzing and (ii) analyzing a particle distribution of the selected reagent mixture of the combined reagent-mixture stream.

A second apparatus is for analysis of reagent mixtures having a plurality of reagent-mixture components. The apparatus includes (1)means for pumping each of a plurality of reagent-mixture components in a respective stream at a respective flow rate, (2) means for introducing at least one reagent-mixture component into a stream of at least one other reagent-mixture component to mix the plurality of reagent-mixture components into a combined reagent-mixture stream, and (3) means coupled in fluid communication with the outlet port

for at least one of (i) chemically analyzing and (ii) analyzing a particle distribution of the combined reagent-mixture stream. The means for introducing includes (a) an elongated mixing chamber defining an upstream end, a downstream end, and an elongated axis extending between the upstream and downstream ends, (b) a first inlet port located at the upstream end of the mixing chamber and coupled in fluid communication with the pumping means, and defining a first inlet axis for introducing a first reagent-mixture component stream into the mixing chamber along the first inlet axis, (c) a second inlet port located downstream of the first inlet port and coupled in fluid communication with the pumping means, and defining a second inlet axis for introducing a second reagent-mixture component stream into the mixing chamber along the second inlet axis, wherein one of the first and second inlet axes is inclined at an acute angle relative to the other and the elongated axis for introducing the respective reagent-mixture component stream into the mixing chamber in a different flow direction than the other reagent-mixture component stream to thereby create turbulence in the combined reagent-mixture stream, and (d) an outlet port located downstream of the inlet ports for receiving the combined reagent-mixture stream.

The method is for analysis of reagent mixtures having a plurality of reagent-mixture components including a sample of blood. The method includes (1) pumping each of a plurality of reagent-mixture components including the sample of blood in a respective stream at a respective predetermined flow rate, (2) combining at least one reagent-mixture component stream into at least one other reagent-mixture component stream to mix the plurality of reagent-mixture components and create a combined reagent-mixture stream, (3) forming each of a plurality of different selected reagent mixtures in the combined reagent-mixture stream by adjusting the flow rate of at least one of a plurality of reagent-mixture components in accordance with a respective flow-rate ratio of reagent-mixture components forming each selected reagent mixture, and (4) analyzing the components of each selected reagent mixture.

V. ISSUES

The issue raised in the Final Rejection requiring resolution in this Appeal is as follows:

> Whether claims 1, 3-6, 31 and 33-47 are properly rejected under 35 U.S.C. § 102(b) as being anticipated by EP 0107333.

VI. GROUPING OF CLAIMS

The claims on appeal before the Board of Patent Appeals and Interferences are claims 1, 3-6, 31 and 33-47. Claims 1, 3-6, 40 and 42-47 relate to apparatus for analysis of reagent mixtures having a plurality of reagent-mixture components. Claims 31, 33-39 and 41 relate to methods for analysis of reagent mixtures having a plurality of reagent-mixture components.

The claims on appeal are set forth in the Appendix, and the independent claims 1, 31 and 42 are set forth below:

1. An apparatus for at least one of particle and chemical analysis of reagent mixtures having a plurality of reagent-mixture components including a sample of blood, comprising:

means for pumping each of a plurality of reagent-mixture components including the sample of blood in a respective stream at a respective predetermined flow rate;

means for combining at least one reagent-mixture component stream into a stream of at least one other reagent-mixture component stream for mixing the plurality of reagent-mixture components into a combined reagent-mixture stream;

means for forming each of a plurality of different selected reagent mixtures in the combined reagent-mixture stream by adjusting the flow rate of at least one of a plurality of reagent-mixture components in accordance with a flow-rate ratio of reagent-mixture components corresponding to each respective selected reagent mixture; and

means for at least one of (i) chemically analyzing and (ii) analyzing a particle distribution of the selected reagent mixture of the combined reagent-mixture stream.

31. A method for at least one of particle and chemical analysis of reagent mixtures having a plurality of reagent-mixture components including a sample of blood, comprising the steps of:

pumping each of a plurality of reagent-mixture components including the sample of blood in a respective stream at a respective predetermined flow rate;

combining at least one reagent-mixture component stream into at least one other reagent-mixture component stream to mix the plurality of reagent-mixture components and create a combined reagent-mixture stream;

forming each of a plurality of different selected reagent mixtures in the combined reagent-mixture stream by adjusting the flow rate of at least one of a plurality of reagent-mixture components in accordance with a respective flow-rate ratio of reagent-mixture components forming each selected reagent mixture; and

analyzing the components of each selected reagent mixture.

42. An apparatus for at least one of particle and chemical analysis of reagent mixtures having a plurality of reagent-mixture components, comprising:

means for pumping each of a plurality of reagent-mixture components in a respective stream at a respective flow rate;

means for introducing at least one reagent-mixture component into a stream of at least one other reagent-mixture component to mix the plurality of reagent-mixture components into a combined reagent-mixture stream, said means including:

an elongated mixing chamber defining an upstream end, a downstream end, and an elongated axis extending between the upstream and downstream ends,

a first inlet port located at the upstream end of the mixing chamber and coupled in fluid communication with the pumping means, and defining a first inlet axis for introducing a first reagent-mixture component stream into the mixing chamber along the first inlet axis,

a second inlet port located downstream of the first inlet port and coupled in fluid communication with the pumping means, and defining a second inlet axis for introducing a second reagent-mixture component stream into the mixing chamber along the second inlet axis, wherein one of the first and second inlet axes is inclined at an acute angle relative to the other and the elongated axis for introducing the respective reagent-mixture component stream into the mixing chamber in a different flow direction than the other reagent-mixture component stream to thereby create turbulence in the combined reagent-mixture stream, and

an outlet port located downstream of the inlet ports for receiving the combined reagent-mixture stream; and

means coupled in fluid communication with the outlet port for at least one of (i) chemically analyzing and (ii) analyzing a particle distribution of the combined reagent-mixture stream.

Pursuant to 37 C.F.R. § 1.192(c)(7), Appellant hereby groups the pending claims for purposes of appeal as follows:

Claims 1, 3-6, 40 and 45-46 stand rejected under 35 U.S.C. § 102(b) as anticipated by EP '333	Rejected claims stand or fall together
Claims 31, 33-39 and 41 stand rejected under 35 U.S.C. § 102(b) as anticipated by EP '333	Rejected claims stand or fall together
Claims 42-44 stand rejected under 35 U.S.C. § 102(b) as anticipated by EP '333	Rejected claims stand or fall together

VII. ARGUMENT

Claims 1, 3-6, 31 and 33-47 stand rejected under 35 U.S.C. § 102(b) as being anticipated by EP 0107333 (hereinafter "EP '333"). The Examiner's grounds for rejection are hereinafter traversed, and allowance respectfully requested, in view of the arguments below.

A. EP '333 Does Not Teach or Suggest The Invention Recited in Claim 1.

First, EP '333 does not teach or suggest the combination of "means for combining at least one reagent-mixture component stream into at least one other reagent-mixture component stream for mixing the plurality of reagent-mixture components into a combined reagent-mixture stream" and "means for either chemically analyzing, or analyzing a particle distribution of, the selected reagent mixture in the combined reagent mixture stream", as recited in claim 1.

Although EP '333 shows three blood sample-reagent mixtures and three sheath liquids (each of the three sheath liquids being optically compatible with a respective one of the blood sample-reagent mixtures), none of the blood sample-reagent mixtures is combined with any of the other blood sample-reagent mixtures. Further, although each of the blood sample-reagent mixtures is mixed with a respective one of the sheath liquids, they are not mixed until after they are each analyzed and upon exiting the flow cell. Applicants admit that EP '333 describes concomitant flow of a blood sample-reagent mixture and its respective sheath liquid through the flow cell. However, contrary to the Examiner's assertion, this does not teach or suggest combining streams "for mixing ... into a combined ... stream", as recited in claim 1. Indeed, EP '333 explicitly teaches not to mix the concomitant flows prior to and within the flow cell. Moreover, EP '333 does not mix the concomitant flows until they exit the flow cell and are discarded as waste. Accordingly, EP '333 teaches away from the combination recited in independent claim 1.

Specifically, EP '333 teaches that reaction vessel 40 contains the blood sample and appropriate reagent mixture for counting and sizing red blood cells and platelets, reaction vessel 42 contains the blood sample and appropriate reagent mixture for counting and sizing basophils, and reaction vessel 44 contains the blood sample and appropriate reagent mixture for sizing and counting all other white blood cells except basophils. (See, e.g., page 10, line 29 through page 11, line 12 of EP '333). The sheath fluid reservoirs 96, 98 and 100 each contain a sheath liquid that is optically compatible with the respective mixture contained in a corresponding reaction vessel 40, 42 or 44. (See, id.)

During operation, each sample-reagent mixture contained in a respective reaction vessel 40, 42, or 44 and the corresponding compatible sheath liquid contained in the respective sheath fluid reservoir 96, 98 or 100 are pumped through the flow cell 12. The

sample-reagent mixtures contained in the reaction vessels 40, 42 and 44 are not pumped through the flow cell at the same time. Rather, only one sample-reagent mixture and corresponding sheath fluid are pumped through the flow cell at any one time. (See, e.g., page 4, lines 7-10, and lines 29-33 of EP '333).

EP '333 further teaches that a blood sample-reagent mixture and its respective sheath are selected for concomitant flow through the flow cell 12 (page 6, lines 25-28). However, the flow cell 12 does not combine the sample and sheath streams, as recited in independent claim 1. Indeed, EP '333 specifically teaches maintaining the sample and sheath fluid -- while being analyzed in the flow cell -- in two separate unmixed streams that are concentrically located at two different diameters. For example, EP '333 states: "the sheath stream flow cell 12 brings the sample and sheath streams introduced at inlets 26 and 28, respectively together to form a pair of concentric, substantially unmixed streams, with the sample stream at the center." (Page 7, lines 7-12 of EP '333, emphasis added). EP '333 further states: "This forms the concentric sample-sheath liquid streams through the flow cell under precisely controlled and coordinated, readily reproducible conditions of constant, and optimal, sample and sheath liquid stream diameters . . . ." (EP '333 at page 14, lines 4-7, emphasis added). Thus, the concentric sample-sheath liquid streams are not mixed prior to or during analysis in the flow cell, but rather are mixed only when discarded as waste in the flow cell outlet. Indeed, the very purpose of maintaining the separate, unmixed streams as taught by EP '333 is to facilitate analysis in the flow cell.

The Examiner asserts at paragraph 10 of the Advisory Action that EP '333 "teaches on page 5 lines 1-10 the concomitant flow of first and second fluids which has been read on the claimed means for combining reagent/sample mixtures in a stream." It is respectfully submitted that this ground for rejection is not correct. As described above, the "concomitant

flow" described at page 5 of EP '333 is not the same as the "means for combining . . ." as recited in independent claim 1. Rather, the adjective "concomitant" is distinctively different in meaning than either of the terms "combining" or "mixing" as recited in Applicant's claims. Webster's Third New International Dictionary sets forth the following definition for "concomitant": "accompanying or attending especially in a subordinate way : occurring along with or at the same time as and with or without causal relationship" . (Webster's Third New International Dictionary, Merriam-Webster Inc., Springfield MA, 1986, p 471). Thus, the "concomitant flow" described by EP '333 at page 5, lines 1-10 clearly means that the first fluid flow accompanies, or occurs along with the second fluid flow in the sheath stream flow cell. However, this passage in no way teaches or suggest "combining" or "mixing" the first and second fluid flows in the sheath stream flow cell, and as recited in independent claim 1. Rather, the ordinary meaning of "combining" is "to cause (as two or more things or ideas) to mix together : mingle, blend". (Webster's Third New International Dictionary, Merriam-Webster Inc., Springfield MA, 1986, p 452). Thus, "concomitant" does not mean "combining". Moreover, "combining" the first and second fluid flows in the sheath stream flow cell, as recited in independent claim 1, would be contrary to the express teachings of EP '333 as set forth above. Accordingly, the passage at page 5, lines 1-10 of EP '333 concerning "concomitant flow" cannot be read on the claimed means for combining reagent/sample mixtures in stream, for at least these reasons.

Thus, the clear and unambiguous teaching of EP '333 is to first premix the separate samples and reagents in the reaction vessels 40, 42 and 44, wherein each premixed sample-reagent mixture is defined by the respective test to be performed thereon. Then, to separately pump each reaction mixture through the flow cell 12 with its corresponding sheath fluid, and

to maintain the reaction mixture and sheath fluid while being analyzed in the flow cell in two separate, unmixed streams that are concentrically located at different diameters.

Accordingly, EP '333 wholly fails to teach or suggest the combination of "means for combining at least one reagent-mixture component stream into at least one other reagent-mixture component stream for mixing the plurality of reagent-mixture components into a combined reagent-mixture stream" and "means for either chemically analyzing, or analyzing a particle distribution of, the selected reagent mixture in the combined reagent mixture stream", as recited in claim 1.

Second, EP '333 does not teach or suggest "forming each of a plurality of different selected reagent mixtures in the combined reagent-mixture stream by adjusting the flow rate of at least one of a plurality of reagent-mixture components in accordance with a flow-rate ratio of reagent-mixture components corresponding to each respective selected reagent mixture", as recited in independent claim 1. Rather, EP '333 forms different selected reagent mixtures by pre-mixing them in the reaction vessels. There is simply no teaching or suggestion in EP '333 of forming such mixtures by combining reagent-mixture streams, much less adjusting the flow rate of the components in accordance with a flow-rate ratio corresponding to the selected reagent-mixture ratio, as recited in the claim.

In addition, it is respectfully submitted that the Examiner has misread at page 2 of the Action the last clause of claim 1. The last clause of claim 1 recites "means for at least one of (i) chemically analyzing and (ii) analyzing a particle distribution of the selected reagent mixture of the combined reagent-mixture stream." The language "the selected reagent mixture of the combined reagent-mixture stream" modifies both "(i) chemically analyzing" and "(ii) analyzing a particle distribution of".

Accordingly, it is respectfully submitted that EP '333 wholly fails to teach or suggest the invention as recited in independent claim 1 for at least these reasons.

B. EP '333 Does Not Teach or Suggest The Invention Recited in Claim 42.

EP '333 does not teach or suggest the combination of "means for introducing at least one reagent-mixture component into a stream of at least one other reagent-mixture component to mix the plurality of reagent-mixture components into a combined reagent-mixture stream" and "means ... for at least one of (i) chemically analyzing and (ii) analyzing a particle distribution of the combined reagent-mixture stream", as recited in claim 42.

As stated above, although EP '333 shows three blood sample-reagent mixtures and three sheath liquids (each of the three sheath liquids being optically compatible with a respective one of the blood sample-reagent mixtures), none of the blood sample-reagent mixtures is combined with any of the other blood sample-reagent mixtures. Further, the blood sample-reagent mixture and respective sheath liquid are maintained in separate, unmixed streams prior to and during analysis in the sheath stream flow cell, and are not mixed until after they exit the flow cell and are discarded as waste. Although EP '333 describes concomitant flow of a blood sample-reagent mixture and its respective sheath liquid, this does not in any way teach or suggest introducing "to mix ... into a combined ... stream", as recited in claim 42. Indeed, EP '333 explicitly teaches not to mix the concomitant flows, and therefore teaches away from the claimed invention. Thus, EP '333 cannot possibly teach or suggest the combination recited in independent claim 42.

Accordingly, it is respectfully submitted that EP '333 wholly fails to teach or suggest the invention as recited in independent claim 42 for at least these reasons.

C. **EP '333 Does Not Teach or Suggest The Invention Recited in Claim 31.**

EP '333 does not teach or suggest "forming each of a plurality of different selected reagent mixtures in the combined reagent-mixture stream by adjusting the flow rate of at least one of a plurality of reagent-mixture components in accordance with a respective flow-rate ratio of reagent-mixture components forming each selected reagent mixture", as recited in claim 31.

As stated above with respect to claim 1, EP '333 forms different selected reagent mixtures by pre-mixing them in the reaction vessels. There is simply no teaching or suggestion in EP '333 of forming such mixtures by combining reagent-mixture streams, much less adjusting the flow rates of the components in accordance with a respective flow-rate ratio of reagent-mixture components forming each selected reagent mixture. Thus, EP '333 cannot possibly teach or suggest the combination recited in independent claim 31.

Accordingly, it is respectfully submitted that EP '333 wholly fails to teach or suggest the invention as recited in independent claim 31 for at least these reasons.

D. **Conclusion**

It is respectfully submitted that independent claims 1, 31 and 42 are not anticipated by EP '333 for at least these reasons. Because claims 3-6, 33-41 and 43-47 each depend from, and therefore include all of the limitations of one of these independent claims, it is respectfully submitted that these dependent claims likewise are also patentable over the EP '333 reference.

Accordingly, for the foregoing reasons, reversal of the Final Rejection of claims 1, 3-6, 31 and 33-47 is warranted and such action is earnestly solicited.

A check in the amount of $160.00 is enclosed for payment of the fee under 37 C.F.R. §1.17(c). No additional fee is believed to be required in connection with this filing. However, if an additional fee is required, or otherwise if necessary to cover any deficiency in fees already paid, authorization is hereby given to charge our deposit account no. 50-1631.

Respectfully submitted,

December 6, 2002

By _____
Mark Giarratana (Reg. No. 32,615)
Attorney for Applicant

PTO Correspondence Address:

Cummings & Lockwood
Granite Square
700 State Street
P.O. Box 1960
New Haven, CT 06509-1960
Phone: (860) 275-6721
Fax: (860) 560-5912

VIII. APPENDIX

The pending claims are as follows:

1. An apparatus for at least one of particle and chemical analysis of reagent mixtures having a plurality of reagent-mixture components including a sample of blood, comprising:

means for pumping each of a plurality of reagent-mixture components including the sample of blood in a respective stream at a respective predetermined flow rate;

means for combining at least one reagent-mixture component stream into a stream of at least one other reagent-mixture component stream for mixing the plurality of reagent-mixture components into a combined reagent-mixture stream;

means for forming each of a plurality of different selected reagent mixtures in the combined reagent-mixture stream by adjusting the flow rate of at least one of a plurality of reagent-mixture components in accordance with a flow-rate ratio of reagent-mixture components corresponding to each respective selected reagent mixture; and

means for at least one of (i) chemically analyzing and (ii) analyzing a particle distribution of the selected reagent mixture of the combined reagent-mixture stream.

3. An apparatus as defined in claim 1, wherein the means for pumping includes a plurality of pumps, each pumping a respective reagent-mixture component, and the means for forming each of a plurality of different selected reagent mixtures is coupled to and controls the flow rate of each pump to, in turn, control the flow rate of at least one of the plurality of reagent-mixture components in accordance with the flow-rate ratio of the reagent-mixture components corresponding to a selected reagent mixture.

4. An apparatus as defined in claim 3, further comprising a plurality of pump motors, each pump motor being coupled to a respective pump to control the flow rate of the pump and a respective reagent-mixture component.

5. An apparatus as defined in claim 1, wherein the means for forming comprises a control unit coupled to the means for pumping and including a database of predetermined reagent-mixture ratios, wherein each predetermined reagent-mixture ratio corresponds to one or more animal species, and the control unit is responsive to an input for a selected animal species to control the means for pumping to pump the reagent-mixture components of the respective reagent-mixture ratio of the selected animal species at a flow-rate ratio corresponding to the reagent-mixture ratio.

6. An apparatus as defined in claim 1, further comprising a plurality of reagent-mixture component chambers, wherein each reagent-mixture component chamber contains a respective reagent-mixture component and is coupled in fluid communication with the means for pumping for supplying reagent-mixture components to the means for pumping.

31. A method for at least one of particle and chemical analysis of reagent mixtures having a plurality of reagent-mixture components including a sample of blood, comprising the steps of:

pumping each of a plurality of reagent-mixture components including the sample of blood in a respective stream at a respective predetermined flow rate;

combining at least one reagent-mixture component stream into at least one other reagent-mixture component stream to mix the plurality of reagent-mixture components and create a combined reagent-mixture stream;

forming each of a plurality of different selected reagent mixtures in the combined reagent-mixture stream by adjusting the flow rate of at least one of a plurality of reagent-mixture components in accordance with a respective flow-rate ratio of reagent-mixture components forming each selected reagent mixture; and

analyzing the components of each selected reagent mixture.

33. A method as defined in claim 31, wherein each flow-rate ratio of the reagent-mixture components is approximately equal to the mixture ratio of the respective reagent mixture.

34. A method as defined in claim 31, further comprising the steps of creating a database including a plurality of predetermined reagent-mixture ratios, wherein each reagent-mixture ratio corresponds to one or more species, and creating a reagent mixture for each of a plurality of selected species by pumping the reagent-mixture components of the reagent-mixture ratio for a selected species at a flow-rate ratio corresponding to the respective reagent-mixture ratio.

35. A method as defined in claim 34, wherein the flow-rate ratio is approximately equal to the respective reagent-mixture ratio for each selected species.

36. A method as defined in claim 31, further comprising the step of directing the plurality of reagent-mixture components in the combined reagent-mixture stream through a tortuous path to facilitate mixing the reagent-mixture components into a selected reagent mixture.

37. A method as defined in claim 31, further comprising the step of accelerating and decelerating the flow rate of the reagent-mixture components in the combined reagent-mixture stream to facilitate mixing the reagent-mixture components into a selected reagent mixture.

38. A method as defined in claim 31, further comprising the step of directing the combined reagent-mixture stream through a flow path defined by relatively expanded and relatively constricted portions to facilitate mixing the reagent-mixture components into a selected reagent mixture.

39. A method as defined in claim 31 for hematology testing and analyzing particle distributions within the reagent mixtures for blood cell analysis, comprising the steps of pumping a plurality of reagent-mixture components selected from the group including (i) a whole blood sample of a selected species, (ii) diluent, and (iii) a lysing agent, and forming a blood/diluent/lyse reagent mixture corresponding to the selected species.

40. An apparatus as defined in claim 1, wherein the means for forming forms the selected reagent mixture by adjusting the flow rates of at least two reagent-mixture components in accordance with the respective flow-rate ratio.

41. A method as defined in claim 31, comprising the step of forming each reagent mixture by adjusting the flow rates of at least two reagent-mixture components in accordance with the respective flow-rate.

42. An apparatus for at least one of particle and chemical analysis of reagent mixtures having a plurality of reagent-mixture components, comprising:

means for pumping each of a plurality of reagent-mixture components in a respective stream at a respective flow rate;

means for introducing at least one reagent-mixture component into a stream of at least one other reagent-mixture component to mix the plurality of reagent-mixture components into a combined reagent-mixture stream, said means including:

an elongated mixing chamber defining an upstream end, a downstream end, and an elongated axis extending between the upstream and downstream ends,

a first inlet port located at the upstream end of the mixing chamber and coupled in fluid communication with the pumping means, and defining a first inlet axis for introducing a first reagent-mixture component stream into the mixing chamber along the first inlet axis,

a second inlet port located downstream of the first inlet port and coupled in fluid communication with the pumping means, and defining a second inlet axis for introducing a second reagent-mixture component stream into the mixing chamber along the second inlet axis, wherein one of the first and second inlet axes is inclined at an acute angle relative to the other and the elongated axis for introducing the respective reagent-mixture component stream into the mixing chamber in a different flow direction than the other reagent-mixture component stream to thereby create turbulence in the combined reagent-mixture stream, and

an outlet port located downstream of the inlet ports for receiving the combined reagent-mixture stream; and

means coupled in fluid communication with the outlet port for at least one of (i) chemically analyzing and (ii) analyzing a particle distribution of the combined reagent-mixture stream.

43. An apparatus as defined in claim 42, wherein the second inlet port is angularly spaced relative to the first inlet port and defines a second inlet axis oriented transverse to the elongated axis, and the second inlet port is coupled in fluid communication with the pumping means for introducing a second reagent-mixture component stream into the mixing chamber in a different flow direction than the first reagent-mixture component stream to thereby create turbulence in the combined reagent-mixture stream.

44. An apparatus as defined in claim 42, further comprising means for forming each of a plurality of different selected reagent mixtures in the combined reagent-mixture stream by adjusting the flow rate of at least one of a plurality of reagent-mixture components in accordance with a flow-rate ratio of reagent-mixture components corresponding to each respective selected reagent mixture.

45. An apparatus as defined in claim 1, wherein the means for forming comprises a control unit electrically coupled to the means for pumping to set the flow rates of the reagent-mixture components in accordance with the flow-rate ratio of each selected reagent mixture.

46. An apparatus as defined in claim 45, wherein the control unit includes a database of information pertaining to the flow-rate ratios of the reagent-mixture components of the selected reagent mixtures.

47. An apparatus as defined in claim 1, wherein the means for combining includes a mixing chamber, a plurality of inlet ports coupled in fluid communication between the mixing chamber and the means for pumping for introducing the reagent-mixture components into the mixing chamber, and at least one outlet port coupled in fluid communication between the mixing chamber and the means for analyzing for introducing the combined reagent-mixture stream into the means for analyzing.